PMT 90-S002G

MILES COMMUNICATION CODE 97 (MCC97)STANDARD
Last update 23 March 2001

DEPARTMENT OF THE ARMY
SIMULATION, TRAINING AND INSTRUMENTATION COMMAND

(Supercedes "Standard for MILES Communication Code Structure"
Document PMT 90-S002 dt. 18 June 1991) **MCC97 STANDARD**

1. SCOPE.

The MCC97 Standard defines the MILES Communication Code Structure for encoding/decoding weapon type, ammunition type, player identification, and weapon/ammunition lethality effects information transported through the MILES intra-system communication channels and interfaces and through interfaces with external systems.
This MCC97 Standard supercedes the previous version, entitled "Standard for MILES Communication Code Structure", dated 18 June 1991. The revisions/improvements include the following:

- Provides approximately five (5) times more Identification (ID) code capacity to handle Player Identification and weapon ammunition information encoding.
- Provides better description of MILES code structure.
- Adds Probability of Kill (Pk) tables.
- Provides a clear and concise step by step procedure to construct MCC97 code designator.
- Adds encoding/decoding routine for Fire and Forget missile weapons.
- Provides design parameters in Appendices D & E and Attachment 1.

2. REFERENCE DOCUMENTS. None.

3. REQUIREMENTS.
MCC97 will have the information content, format, and functions specified herein.

3.1 MCC97 Encoded Information Content.
MCC97 contains the following encoded information in its structure:

- Weapon type: For example, 120mm Main Tank Gun, TOW Missile, M16 Rifle, etc.
- Ammunition type: For example, 120mm Heat Round, TOW II Missile, 50 Cal Round, etc.
- Weapon/Ammunition effects at target as follows:
  1. Hit: Heavy weapon class targets with specific degree of lethality effect to be determined by target decoder system.
  2. Hit: Light weapon class targets with specific degree of the lethality effect to be determined by target decoder system.
  3. Near Miss for heavy weapon class.
  4. Near Miss for light weapon class.

d. Player Identification (PID)
  1. Unique identifier for each designated player: man, vehicle, weapon system, organizational unit etc.
  2. Friend or Foe designation.

e. Administrative Function Information:
  1. Bore Sight Code.

2. Reset Command.
3. Resurrect Command.
4. Time Synchronization.
5. Data Download Command.
6. Data Upload Command.
7. Other Functions

3.2 MCC97 Format.

MCC97 format is a digital bit pattern arranged in a clocked time sequence. The time sequenced bit patterns are organized on basic word units that are assembled into successively larger and more information rich structures as follows:

- The **MCC97 Word**, hereafter referred to as **Word,** is the basic bit pattern unit structure.
- The **Message** is a sequence of groups of identical Words. In general, each group will contain an even number of a particular MCC97 Word. Each group will be separated from the following group by a time delay.
- The **Routine** is a sequence of one or more Messages.

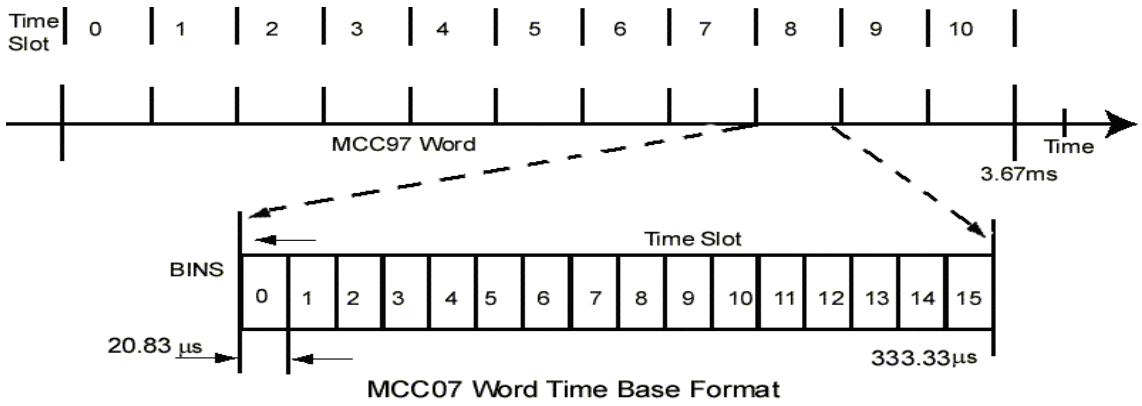
Each successive structure complexity level - **Word, Message**, **Routine** - adds additional information for transport to a MCC97 MILES receiver/decoder.

3.2.1 MCC97 Word Format.

The Word has a structure format that is detailed in the following paragraphs:

3.2.1.1 Word Time Base.

The Word time base clock rate is 48KHz +/-0.015%. The word time base is partitioned into 11 **Time Slots** labeled 0, 1, 2, ... 10. The Time Slot duration is 333.33 μs +/- 0.015% based on the on the 3KHz sub-harmonic of the 48KHz time base clock. Each Time Slot is further subdivided into 16 time intervals; each referred to as a **Bin**. The Bins are numbered by convention 0, 1, …15. Each Bin has time duration of 20.83 μs +/- 0.015% based on the fundamental 48KHz-clock frequency. The Word has a total duration of 3.67 ms +/-0.015%. Refer to Figure 1(below).



MCC07 Word Time Base Format

Figure 1

3.2.1.2 Word Digital Bit Format.
The Word is structured using a digital bit format. The bits are precisely positioned on the Word time base. Logic State 1 represents a communication medium activation: for example an electronic pulse, a laser light pulse, or an ultrasound pulse. Logic State 0 represents the absence of a communication medium activation. Each Logic State 1 is precisely positioned in a specific Bin in a specific Time Slot.

3.2.1.2.1 Word Bit Weight.
Every MCC97 Word contains exactly 10 Logic State 1 for a total **Word Bit Weight** of 10 except:

- Basic MILES Code subset without Player ID. The basic MILES code word is composed of 11 bits with a weight of 6 bits always being Logic State 1 and the remaining 5 bits being Logic State 0. Refer to Appendix A.
- Certain Administrative Function Code Words may have Weight less than 10. Refer to Appendix E.

3.2.1.2.2 Bit Positioning.
Logic State 1 are positioned only in Bin 0, 6, 8, or 10 of a Time Slot and:

- A Word will NEVER have a valid Logic State 1 positioned in Bin 1, 2, 3, 4, 5, 7, 9, 11, 12, 13, 14, or 15.
- There will NEVER be more than two Logic State 1 in any Time Slot.
- A valid Word will ALWAYS have a Logic State 1 in the Bin 0 of its first two Time Slots (Time Slot 0 and Time Slot 1) and a Logic State 0 in Bin 0 of the third Time Slot (Time Slot 2).

3.2.1.3 MCC97 Word Code Designator.
The **MCC97 Word Code Designator** uniquely specifies the exact MCC97 Word bit pattern positioned in its time base. It has the format **X.YZ.SPID** where:

- **X** is a decimal number from 00 to 36, each of which identifies a specific Basic MILES Code bit pattern as listed in Appendix A. Each Logic State 1 in Appendix A is always positioned in a Bin 0 of any Time Slot of a MCC97 Word in which it occurs.
- **SPID (Standard Player Identification)** is a decimal number from 001 to 330 each of which identifies a specific bit pattern as listed in Appendix B. These bit patterns are used to encode desired Player Identification (PID), Ammunition Type and Friend or Foe designation into the MCC97 Word. Refer to Paragraph 3.2.1.5.1 for the method to translate any desired Player ID number, ranging from 0001 to 3300, for any specified allowed ammo type into the MCC97 **YZ.SPID** portion of the Word Designator.
- **Y** is a hexadecimal number, 0 to F, each representing a binary

number, 0000 to 1111, in the order most significant digit to least significant digit. A 0 signifies that the Logic State 1 in the SPID bit pattern in that position is located in a Bin 8 of a Time Slot. A 1 signifies that the Logic State 1 in the SPID bit pattern is located in a Bin 6 of a Time Slot. The most significant **Y** digit applies to the first Logic State 1 of a SPID bit pattern reading from left column to right column (D0 to D10) in Appendix B. The second digit applies to the second Logic State 1, etc.

- **Z** is a hexadecimal number, 0 to F, each representing a binary number, 0000 to 1111, in the order most significant digit to least significant digit. A 1 signifies that the binary bit in the SPID bit pattern is positioned in a Bin 10 of a Time Slot superceding the position specified by the **Y** instruction. A 0 signifies that the bit in the SPID bit pattern remains in the position specified by the **Y** instruction. The most significant **Z** digit applies to the first Logic State 1 of a SPID bit pattern reading from left column to right column (D0 to D10) in Appendix B. The second digit applies to the second Logic State 1, etc.

A complete list of the valid MCC97 PID/Ammo type partition is contained in Appendix C, Table 1, for each **X** entry in Appendix A. Appendix C, Table 2 specifies Bin positions corresponding to the **YZ** portion of the Word Designator.

3.2.1.3.1 Example MCC97 Word Designator Translation to Its Bit Pattern

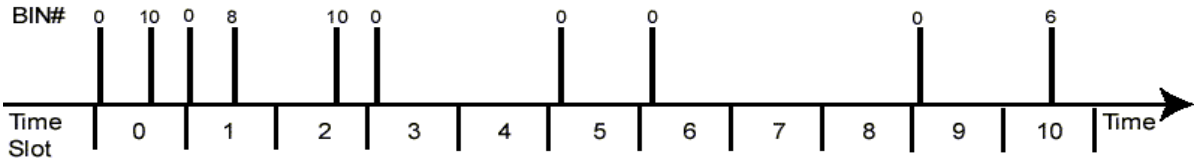
For example, the bit pattern for Word, **12.1A.211,** illustrated in Figure 2, translates as follows:

STEP 1. The first two digits, 12, is **X**, the Basic Miles Code bit pattern. Look this up in Appendix A under the entry **X** = 12. Each Logic State 1 is positioned in Bin 0 of the Time Slot corresponding to its column position in Appendix A. A Logic State 1 in column D0 is positioned in Bin 0 of Word Time Slot 0, etc.

STEP 2. The last three digits, 211, is **SPID**, the bit pattern found in Appendix B under entry 211. Each of the Logic State 1 is positioned in the Time Slot (labeled 0, 1, ... 10) corresponding to the column that the bit occurs (labeled D0, D1, ...D10). Each bit is precisely positioned in either Bin 6, Bin 8, or Bin 10 of its Time Slot according to the instruction contained in the **Y** and **Z** hexadecimal code digits of the Word Designator. In this example, the bit pattern specified by 211 has a Logic State 1 in Time Slots 0 (D0), 1(D1), 2(D2), and 10 (D10).

STEP 3. The **Y** hexadecimal digit, 1, converted to binary in the order most significant bit to least is 0001. A 1 signifies that its corresponding Logic State 1 is positioned in Bin 6 of a Time Slot. A 0 signifies that the corresponding bit is positioned in a Bin 8 of its corresponding Time Slot. In this example, the bit in Time Slot 0 is positioned in Bin 8, the bit in Time Slot 1 is in Bin 8, the bit in Time Slot 2 is in Bin 8, and the bit in Time Slot 10 is in Bin 6.

STEP 4. The **Z** hexadecimal digit, A, converted to binary is 1010. A 1 signifies that the corresponding bit is positioned in a Bin 10 of its Time Slot superceding the instruction of the **Y** hexadecimal digit. A 0 signifies that the corresponding bit remains in the Bin in which it was positioned by the **Y** hexadecimal digit code instruction. In this example, the bit in Time Slot 0 shifts to Bin 10 and the bit in Time Slot 1 remains in Bin 8, the bit in Time Slot 2 shifts to Bin 10, and bit Time Slot 10 remains in Bin 6. The result is the bit pattern for Word, **12.1A.211**, properly structured on its time base shown in Figure 2.



MCC97 Word 12.1.A 211
Bit Pattern

Figure 2

Refer to Appendix C, Table 2 for a list of all valid **YZ.SPID** Designator **SPID** bit pattern Bin locations.

3.2.1.4 Information Contained in the X Designator (Basic MILES Code) Bit Patterns, Appendix A.
Information contained in the bit patterns designated by **X** of the MCC97 Word Designator **X.YZ.SPID** falls into one of the following six categories:
1. **Heavy Weapon *Hit***: Informs a target receiver/decoder that the target has been *Hit* by a heavy weapon/ammunition such as a TOW Missile, 120mm Cannon round, etc. The **X** designations 01 through 26, 32, 33 or 34 in Appendix A form this category.
2. **Heavy Weapon *Near Miss***: Informs a target receiver/decoder that the target has been engaged by a heavy weapon/ammunition and not *Hit,* but rather *Near Missed*. The **X** designations 28 and 31 in Appendix A form this category.
3. **Light Weapon *Hit:*** Informs a target receiver/decoder that the target has been *Hit* by a light weapon/ammunition such as a M16 Rifle Round, etc. The **X** designator 27 in Appendix A forms this category.
4. **Light Weapon *Near Miss:*** Informs a target receiver/decoder that the target has been engaged by a light weapon/ammunition and not *hit, but* rather *Near Missed.* The **X** designator 29 forms this category.
5. **Universal *Kill:*** Informs any target receiver/decoder in the MCC97 system that is has been *killed.* This is a 100% administrative kill effect. The **X** designator 00 forms this category.
6. **Administrative Functions Codes**: Inform target receiver/decoder of special function information such as Bore Sighting Activity, Reset, Resurrect, Time Synchronization, or other administrative functions. The **X** designators 30,35, and 36 form this category.

3.2.1.5 Information Contained in the YZ.SPID Designator.
The information contained in the **YZ.SPID** portion of the MCC97 Word Designator includes:

- Standard Player ID number. Refer to Appendix B.
- Friend or Foe designation. Even Player IDs are Friend; odd are Foe by convention. Refer to Appendix C, Table 1.
- Ammunition (Ammo) type. Appendix C provides an expansion of Weapon/Ammo types based on those types listed in Appendix A.

3.2.1.5.1 Translation of Desired Player ID and Ammo Type to MCC97 Word Designator Format.
The following steps translate any valid MCC97 Player ID number, ranging from 1 to 3300, to the **YZ.SPID** portion of the MCC97 Word Designator format. Refer to Appendix C, Table 1. Using Table 1,

proceed as follows:
Step 1: Select Friend (BLUEFOR) or Foe (OPFOR) category.
Step 2: Select the desired ammo type consistent with the selection made in Step 1.
Step 3: Select the desired Player ID number, 1 through 3300 consistent with selection made in Step 2.
Step 4: Determine the **Serial Number** consistent with the selections made in the above Steps from Appendix C, Table 1, Column 1, and the corresponding code prefix hexadecimal number resulting in "**YZ**" from Appendix C, Table 1, Column 2.
Step 5: Multiply the **Serial Number** by the number, 330.
Step 6: Subtract the resulting number from the selected Player ID number. This is the Word Designator **SPID** number.
Step 7: The MCC97 **YZ.SPID** portion of the Word Designator is the combination of the hexadecimal number determined in Step 3 and the resultant **SPID** number from Step 6.
Some examples are:

MCC97 Player ID	Ammo Type	**YZ.SPID**
2900	Ammo D	1C.260
0001	Ammo H	C0.001
1201	Ammo F	70.211

3.2.2 Message Format.
The Message is structured in time sequence in the most general case with format as follows:

- A group of Words containing a number, K, of identical Heavy Weapon Hit Words, where K=0, or multiples of 2.
- Followed by a time delay, D1, to prevent code jamming in the decoder system.
- Followed by a group Words containing a number, M, of identical Light Weapon Hit Words, where M=0, or multiples of 2.
- Followed by a time delay, D2, to prevent code jamming in the decoder system.
- Followed by a group of identical Heavy Weapon Near Miss Words, Nh followed by a time delay D3 and/or a group Light Weapon Near Miss Words, Nl where, Nh and/or Nl each or both are 0 or multiples of 2.

The values for each of the Message parameters: K, M, Nh, Nl, D, D1, D2, D3 for a particular application are specified in Appendix D for encoding and/or decoding processing.

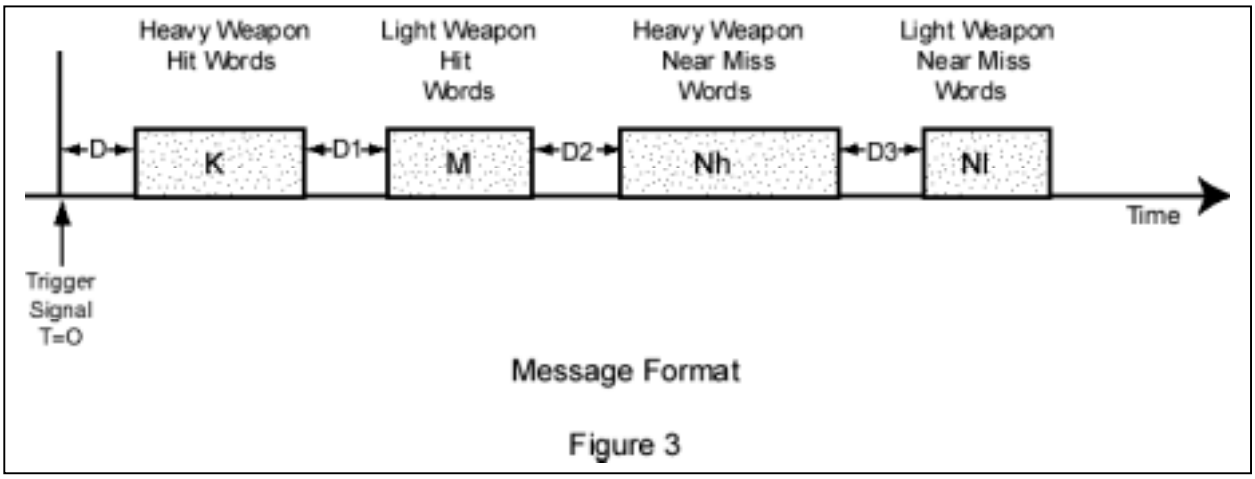


Figure 3

3.2.2.1 Direct Fire Weapon Message.

The direct Fire Weapon Message communicates specified information for weapons/ammunitions that are aimed and released at a target with no other further guidance beyond the original release conditions. These are communicated in a message routine format described in paragraph 3.2.3.1. The Direct Fire Weapon Message format is D K D1 M D2 Nh D3 and/or Nl. Refer to Figure 3(above). Refer to Attachment 1 for Direct Fire Message adaptation for high rate of fire weapons.

3.2.2.2 Guided Missile Weapon Message.
The Guided Missile Weapon Message communicates specified information for weapons/ammunitions that are aimed, released and guided by the operator until the weapon/ammunition makes contact with the target or reaches its maximum time of flight. The Guided Missile Weapon Message format is: K where K contains a specified even number of Words. These are transmitted in a Message Routine format described in Paragraph 3.2.3.2.

3.2.2.3 Fire and Forget Missile Weapon Message.
The Fire and Forget Missile Weapon Message communicates specified information for weapons that are aimed, and released by the operator but then seek a target in the designated target window guided by internal *smart* or *seeker* systems. The Fire and Forget Weapon Message format is D K D1 M D2 Nh D3 N1 where K contains a specified even number of Words. These are communicated in a Message Routine format described in Paragraph 3.2.3.3.

3.2.2.4 Administrative Function Messages.
An Administrative Function Message communicates special information and/or administrative command such as a Time Synchronization, Reset, Resurrect, Ammunition Upload, Universal Kill, Communication Kill, Bore Sight etc. Each Administrative Function Message has a unique format. In general, each type Administrative Function Message is transmitted in a Message Routine format described in Paragraph 3.2.3.4.

3.2.3 MCC97 Message Routine Format.

MCC97 Message Routine format is a series of Messages in a time sequence string. Message Routine types are as follows:

3.2.3.1 Direct Fire Routine (DFR).

The Direct Fire Routines are as follows:

- Heavy Weapons Routine Format: The format is: D K D1 M D2 Nh D3 Nl. Refer to Figure 3.
- Light Weapons Routine: The format is: D M D2 Nl.

Refer to Appendix D for encoding and decoding parameter specifications.

3.2.3.2 Guided Missile Routine (GMR).

The Guided Missile Routine starts with a trigger signal followed by an initial time delay D. Next follows the Initial Guidance Sequence (IGS) containing a number, Ig, of Guided Missile Messages (GMM) with a time delay, D_A, between each GMM. Then follows the Final Guidance Sequence (FGS) containing a number, Fg, of GMMs spaced with a time delay, D_B, between each. Finally, a Light Weapon Hit Message, M, positioned after a time delay of D1 at the end of the sequence completes the GMR. The GMM shall consists of eight (8) Heavy Weapon Hit Words.

In general, the GMR format is: Trigger Signal - D - GMM D_A GMM D_A (repeated Ig times). - GMM D_B GMM D_B GMM D_B (repeated Fg times) D1 M where GMM is a particular MCC97 Guided Missile Message and M is a Light Weapon Hit Message. D is an initial time delay; D_A and D_B are time delays that will be inserted to simulate missile time of flight and missile guidance tracking characteristics.

The two separate GMM sequences, IGS, and FGS, are formulated to accommodated the time of flight and the guidance characteristics of a particular guided missile weapon. Usually, the missile guidance is more critical near the end of the time of flight so that D_A is larger than D_B and the number, Ig, of GMMs in the IGS is less than the number, Fg, of GMMs in the FGS. The MCC97 decoder must successfully decode a specified number, Gk, of GMMs from the combined IGS and FGS of the total Guided Missile Routine. Refer to Figure 4 (below) for Guided Missile Routine format and to Appendix D for GMR parameter values for a particular Guided Missile Weapon in the MILES system.

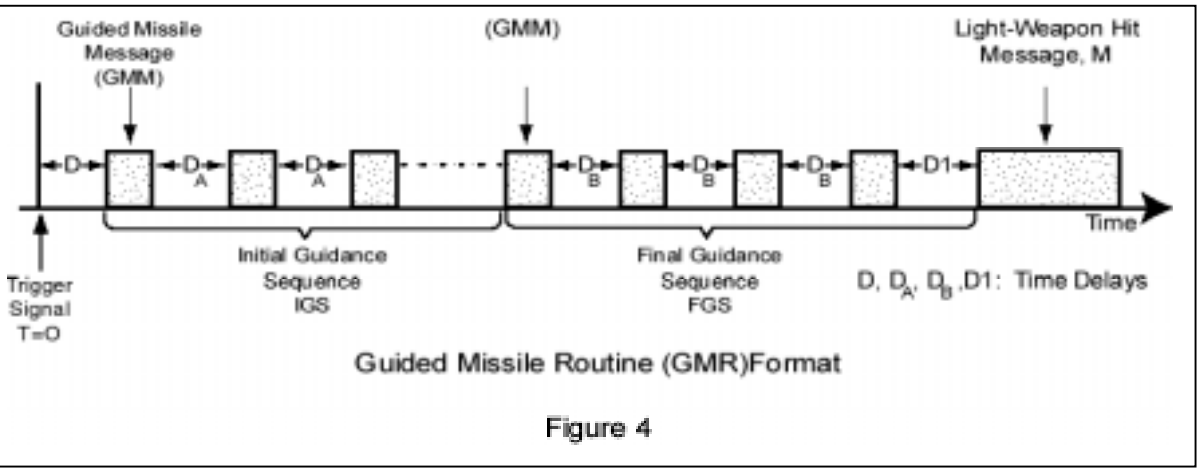
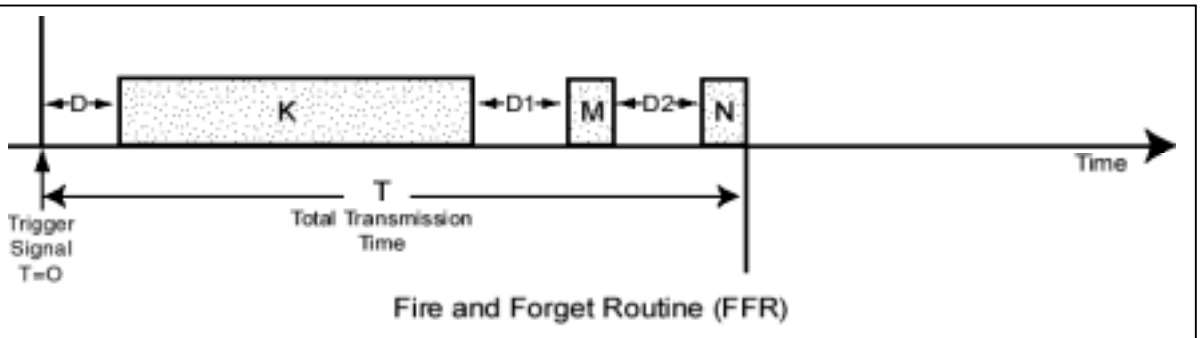


Figure 4

3.2.3.3 Fire and Forget Routine (FFR):
The Fire and Forget Routine is sequence of at least two MCC97 Code 09 Heavy Weapon Hit Words with the possibility of having the maximum even number of K Words with or without any time delays between. This is followed by a group of M Light Weapon Hit Words, where M =0 or multiples of 2, with or without a time delay D1.



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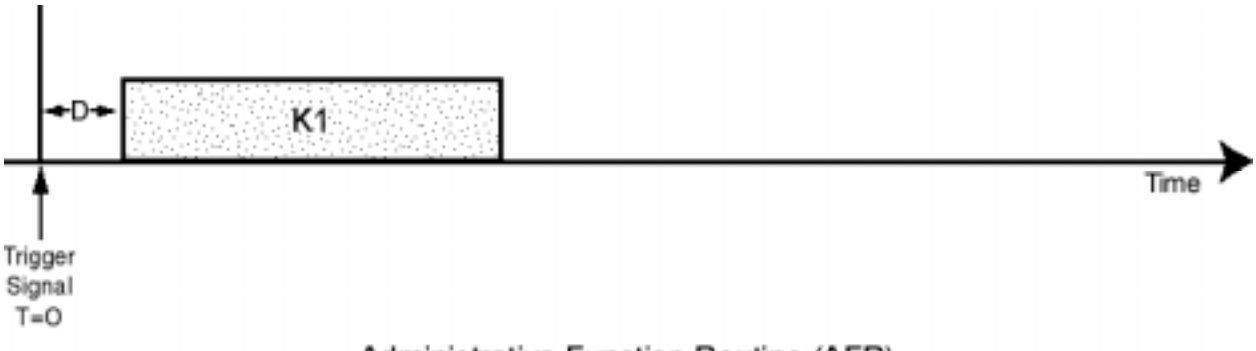
This is followed by a group of N near miss words, where N =0 or multiples of 2, with or without a time delay D2. The transmission time will not exceed a total of T seconds per trigger pull. Refer to Figure 5 (above) for Fire and Forget Routine format and to Appendix D for encoding and decoding parameter values for K, D1, M, D2, N and T.

3.2.3.4 Administrative Function Routine (AFR):
The Administrative Function Routine is unique for each administrative function. An Administrative Function Routine for functions other than "Boresight" is a trigger signal followed by an initial time delay D. Next follows a group of K1 Administrative Function Words, where K1 is a multiple of 2. Refer to figure 6 (above) and Appendix E for AFR encoding and



Administrative Function Routine (AFR)

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decoding parameter values for K1.
An administrative Function Routine for "Boresight" function is a continuos transmission data bit pattern shown in Appendix A.

4.0 MCC97 Routine Decoding Scheme.
The MCC97 Routine Decoding Scheme requires MCC97 Word reception and decoding as follows:

4.1 Direct Fire Weapon Routine (DFR) Decoding.
The DFR decoding scheme requires the reception for decoding the number of Words per Direct Fire Weapon Message as follows:

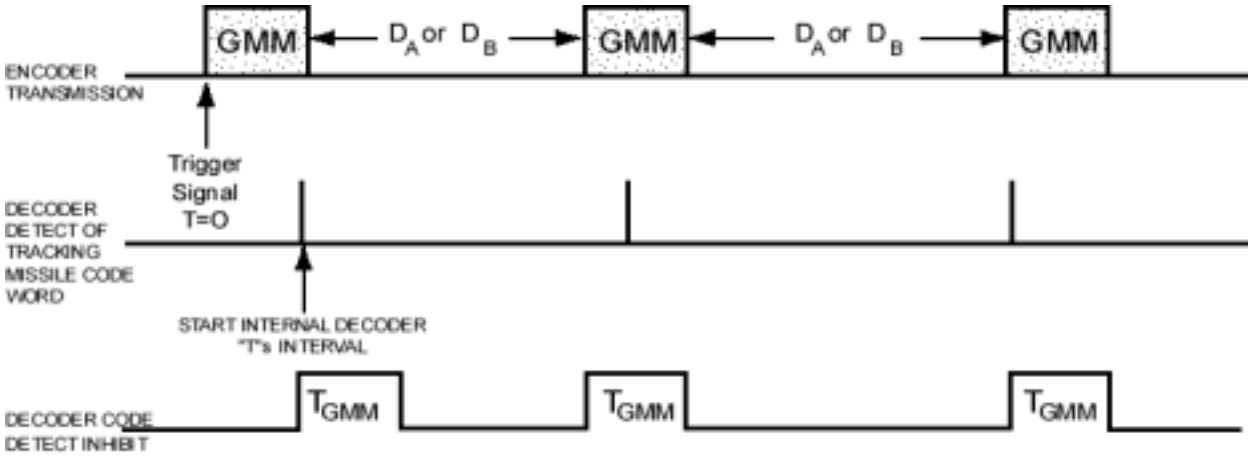
- Two (2) Hit Words or two (2) Near Miss Words within an eight (8) Word time period for Heavy Weapon Messages. The Heavy Weapon Words have **x** designations 01 through 26, 28, 32, 33 and 34 in Appendix A.
- Two (2) Hit Words or two (2) Near Miss Word within an eight (8) Word time period for Light Weapon Messages. The Light Weapon Word has **x** being 27 and 29 Appendix A.

- Refer to Attachment 1 for Lethality Effects Assessment Routine.

4.2 Guided Missile Routine (GMR) Decoding.

The GMR decoding scheme is triggered by the reception and decoding of the first Guided Missile Word in a GMM. Refer to Figure 4. This event initiates a tracking interval time window for decoding the instant GMR which is T seconds long as specified as a design parameter for a specified guided missile weapon in Appendix D. The GMR has Ig +Fg total GMMs available for decoding during tracking interval T. The GMR decoding scheme permits only one Word decoding per GMM. As soon as a Word is successfully decoded in a GMM, an inhibit for a time period equivalent to one GMM (T_{GMM}) is imposed to prevent any further Word decoding during that period. Refer to Figure 7 (below).

An accumulation of a total of Gk GMMS during the tracking time T is required to trigger a Hit evaluation response. An accumulation of 2 through Gk-1 decoded GMMs will result in a Near Miss evaluation response. Refer to Attachment 1 for Lethality Effects Assessment Routine.



Decoder Timing - Guided Missile Routine

Figure 7

4.3 Fire and Forget Missile Routine (FFR) Decoding.

The FFR missile-decoding scheme is triggered by the reception and decoding of the first Fire and Forget Weapon Word. This event initiates a decoding window of duration of two seconds. The successful decoding of N Fire and Forget Words accumulated in the decoding window of duration will result in a hit evaluation response. The accumulation of fewer than N decoded Words during period of two seconds or the reception of a near miss Word in the absence of a decoded hit Word during the two second window will result in a near miss evaluation. The design parameters N for a specified Fire and Forget Weapon are listed in Appendix D. Refer to Attachment 1 for Lethal Effects Assessment Routine.

4.4 Administrative Function Routine (AFR) Decoding.
The AFR decoding scheme for functions other than "Boresight" requires the decoding of two (2) Hit Words within an eight (8) Word time period.

5.0 Lethality Effects Assessment Routine and Tables.
Refer to Attachment 1.

6.0 Probability of Kill (Pk) Charts.
The charts are available on the STRICOM WEB SITE at xxxx@stricom.army.mil

7.0 MCC97 Word Set Partitioning Management.
STRICOM manages the MCC97 Word Set Map including its partitioning and Ammo Type assignment for particular applications and periodic revision and distribution by:

- Maintaining the MILES system **MCC97 Word Code Book**. The **Code Book** contains the current configuration managed assignment of every MCC97 Word. The Code Book is available on the STRICOM WEB SITE at xxxx@STRICOM.army.mil.
- Assigning sub-blocks of MCC97 Words for specific applications under STRICOM configuration control management.
- Processing requests for sub-blocks of MCC97 Words for a specific application. Refer to Appendix F for application form and instructions to apply for a sub-block of MCC97 Word.

APPENDIX A

BASIC MILES CODE STRUCTURE

D D D	DATA D D D D	BITS D D D D	BASIC MILES CODE NO.	WEAPON/FUNCTION
0 1 2	3 4 5 6	7 8 9 10		
1 1 0	0 0 1 0	1 1 0 1	00	UNIV. KILL, CONTR, GUN, 100% KILL
1 1 0	1 0 0 1	0 0 1 1	01	MAVERICK HIT
1 1 0	0 0 1 1	0 1 0 1	02	HELLFIRE HIT
1 1 0	0 0 1 0	1 0 1 1	03	AT-3 SAGGER (NTC BMP) HIT
1 1 0	0 1 0 1	0 0 1 1	04	60MM, 81MM, 4.2 INCH HIT
1 1 0	1 0 1 0	1 0 0 1	05	M15 MINE (TRACK CUTTER) HIT
1 1 0	0 1 1 0	0 1 0 1	06	WEAPON "X" HIT
1 1 0	1 1 0 1	1 0 0 0	07	TOW, SHILLELACH, AT-6 (NTC HIND-D HIT
1 1 0	1 0 1 1	0 1 0 0	08	DRAGON, SPANDREL (NTC BRDM-2) HIT
1 1 0	1 1 0 0	1 0 0 1	09	FIRE & FORGET MISSILES (JAVELIN)
1 1 0	0 1 1 0	1 0 0 1	10	M21 ANTITANK, 125MM (NTC T72) HIT
1 1 0	0 1 0 0	1 0 1 1	11	CLAYMORE M81A1 AND M16 HIT
1 1 0	1 0 1 1	0 0 1 0	12	105MM HIT
1 1 0	1 1 0 0	1 0 1 0	13	152MM, 122MM (NTC M1974) HIT
1 1 0	0 1 0 1	1 0 0 1	14	2.75 ROCKET, 57MM ROCKET (NTC HIND-D), 73MM (NTC BMP) HIT
1 1 0	1 0 1 0	1 1 0 0	15	VIPER HIT
1 1 0	0 1 0 1	0 1 0 1	16	120MM HIT
1 1 0	1 0 0 1	0 1 0 1	17	90MM HIT, MPIM/SRAW
1 1 0	0 1 1 0	0 0 1 1	18	8 INCH, 105MM HOW, 122MM, 155MM HIT
1 1 0	1 0 1 1	0 0 0 1	19	40MM GRENADE HIT
1 1 0	1 1 0 0	0 1 0 1	20	ROCKEYE (CLUSTER BOMB) HIT
1 1 0	1 1 0 1	0 1 0 0	21	GAU-8, AH-64, 30MM HIT
1 1 0	0 0 1 1	0 0 1 1	22	25MM, ZSU-23/4 VISUAL MODE (NTC) HIT
1 1 0	1 0 0 0	1 0 1 1	23	VULCAN, AIR 20MM, 30MM (NTC HIND-D) HIT
1 1 0	0 0 0 1	0 1 1 1	24	M2, M85, MACHINE GUN HIT
1 1 0	1 0 0 0	1 1 0 1	25	CHAPARRAL HIT
1 1 0	0 1 0 0	1 1 0 1	26	STINGER HIT
1 1 0	0 1 0 0	0 1 1 1	27	M16 RIFLE, M60 MG, COAX MG HIT
1 1 0	1 1 1 0	0 0 0 1	28	HEAVY MISS: 105MM, 152MM, 73MM, VIPER
1 1 0	0 0 1 0	0 1 1 1	29	LIGHT MISS: M16 RIFLE, M60 MG, COAX MG. ZSU-23/4, ETC.
1 1 0	1 0 0 0	0 1 1 1	30	LIGHT SPARE MISS, RESET FOR AIRCRAFT SYSTEMS, RESURRECT FOR GROUND SYSTEMS
1 1 0	1 0 1 0	0 0 1 1	31	HEAVY SPARE MISS
1 1 0	1 0 0 1	1 0 0 1	*32	IFS ACTUATION
1 1 0	1 0 1 0	0 1 0 1	*33	SA-14 (NTC) HIT
1 1 0	1 1 0 0	0 0 1 1	*34	ZSU-23/4 RADAR MODE (NTC) HIT
1 1 0	0 0 0 1	1 0 1 1	*35	CONTROLLER GUN/UTILITY CODE ASSIGNMENTS
1 1 0	1 1 0 1	0 0 0 1	*36	RESET FOR GROUND SYSTEMS, RESURRECT FOR AIRCRAFT SYSTEMS
1 0 0	0 0 1 0	0 0 0 1		BORESIGHT (Continuous Transmission)

*NOT USED IN STANDARD MILES EQUIPMENT MILES BORESIGHT CODE STRUCTURE

APPENDIX B

STANDARD MILES PLAYER ID (SPID) CODE ASSIGNMENTS

PLAYER ID	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
1	1	1	1	1	0	0	0	0	0	0	0
2	1	1	1	0	1	0	0	0	0	0	0
3	1	1	0	1	1	0	0	0	0	0	0
4	1	0	1	1	1	0	0	0	0	0	0
5	0	1	1	1	1	0	0	0	0	0	0
6	1	1	1	0	0	1	0	0	0	0	0
7	1	1	0	1	0	1	0	0	0	0	0
8	1	0	1	1	0	1	0	0	0	0	0
9	0	1	1	1	0	1	0	0	0	0	0
10	1	1	0	0	1	1	0	0	0	0	0
11	1	0	1	0	1	1	0	0	0	0	0
12	0	1	1	0	1	1	0	0	0	0	0
13	1	0	0	1	1	1	0	0	0	0	0
14	0	1	0	1	1	1	0	0	0	0	0
15	0	0	1	1	1	1	0	0	0	0	0
16	1	1	1	0	0	0	1	0	0	0	0
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19	0	1	1	1	0	0	1	0	0	0	0
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23	1	0	0	1	1	0	1	0	0	0	0
24	0	1	0	1	1	0	1	0	0	0	0
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26	1	1	0	0	0	1	1	0	0	0	0
27	1	0	1	0	0	1	1	0	0	0	0
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315         0    0    0    0    0    1    1    0    0    1    1
316         1    0    0    0    0    0    0    1    0    1    1
317         0    1    0    0    0    0    0    1    0    1    1
318         0    0    1    0    0    0    0    1    0    1    1
319         0    0    0    1    0    0    0    1    0    1    1
320         0    0    0    0    1    0    0    1    0    1    1
321         0    0    0    0    0    1    0    1    0    1    1
322         0    0    0    0    0    0    1    1    0    1    1
323         1    0    0    0    0    0    0    0    1    1    1
324         0    1    0    0    0    0    0    0    1    1    1
325         0    0    1    0    0    0    0    0    1    1    1
326         0    0    0    1    0    0    0    0    1    1    1
327         0    0    0    0    1    0    0    0    1    1    1
328         0    0    0    0    0    1    0    0    1    1    1
329         0    0    0    0    0    0    1    0    1    1    1
330         0    0    0    0    0    0    0    1    1    1    1
END
```

APPENDIX C

MCC97 CODE PID/AMMO TYPE PARTITION

TABLE -1

Serial No	CODE PREFIX (HEXA-DECIMAL) "YZ"	CODE PREFIX (BINARY)	AMMO TYPE (BLUEFOR)	BLUEFORCE PLAYER ID (EVEN ONLY)	OPFOR PLAYER ID (ODD ONLY)	AMMO TYPE (OPFOR)
0	00	0000 0000	AMMO A	002-330	001-329	AMMO E
1	10	0001 0000		332-660	331-659	
2	20	0010 0000		662-990	661-989	
3	30	0011 0000		992-1320	991-1319	
4	04	0000 0100		1322-1650	1321-1649	
5	05	0000 0101		1652-1980	1651-1979	
6	06	0000 0110		1982-2310	1981-2309	
7	01	0000 0001		2312-2640	2311-2639	
8	02	0000 0010		2642-2970	2641-2969	
9	03	0000 0011		2972-3300	2971-3299	
0	40	0100 0000	AMMO B	002-330	001-329	AMMO F
1	50	0101 0000		332-660	331-659	
2	60	0110 0000		662-990	661-989	
3	70	0111 0000		992-1320	991-1319	
4	0B	0000 1011		1322-1650	1321-1649	
5	0C	0000 1100		1652-1980	1651-1979	
6	07	0000 0111		1982-2310	1981-2309	
7	08	0000 1000		2312-2640	2311-2639	
8	09	0000 1001		2642-2970	2641-2969	
9	0A	0000 1010		2972-3300	2971-3299	

0	80	1000 0000	AMMO C	002-330	001-329	AMMO G
1	90	1001 0000		332-660	331-659	
2	A0	1010 0000		662-990	661-989	
3	B0	1011 0000		992-1320	991-1319	
4	14	0001 0100		1322-1650	1321-1649	
5	16	0001 0110		1652-1980	1651-1979	
6	0D	0000 1101		1982-2310	1981-2309	
7	0E	0000 1110		2312-2640	2311-2639	
8	0F	0000 1111		2642-2970	2641-2969	
9	12	0001 0010		2972-3300	2971-3299	
0	C0	1100 0000	AMMO D	002-330	001-329	AMMO H
1	D0	1101 0000		332-660	331-659	
2	E0	1110 0000		662-990	661-989	
3	F0	1111 0000		992-1320	991-1319	
4	21	0010 0001		1322-1650	1321-1649	
5	24	0010 0100		1652-1980	1651-1979	
6	18	0001 1000		1982-2310	1981-2309	
7	1A	0001 1010		2312-2640	2311-2639	
8	1C	0001 1100		2642-2970	2641-2969	
9	1E	0001 1110		2972-3300	2971-3299	
0	25	0010 0101	AMMO I	002-330	001-329	AMMO M
1	28	0010 1000		332-660	331-659	
2	29	0010 1001		662-990	661-989	
3	2C	0010 1100		992-1320	991-1319	
4	2D	0010 1101		1322-1650	1321-1649	
5	34	0011 0100		1652-1980	1651-1979	
6	38	0011 1000		1982-2310	1981-2309	
7	3C	0011 1100		2312-2640	2311-2639	
8	41	0100 0001		2642-2970	2641-2969	
9	42	0100 0010		2972-3300	2971-3299	
0	43	0100 0011	AMMO J	002-330	001-329	AMMO N
1	48	0100 1000		332-660	331-659	
2	49	0100 1001		662-990	661-989	
3	4A	0100 1010		992-1320	991-1319	
4	4B	0100 1011		1322-1650	1321-1649	
5	52	0101 0010		1652-1980	1651-1979	
6	58	0101 1000		1982-2310	1981-2309	
7	5A	0101 1010		2312-2640	2311-2639	
8	61	0110 0001		2642-2970	2641-2969	
9	68	0110 1000		2972-3300	2971-3299	

0	69	0110 1001	AMMO K	002-330	001-329	AMMO O
1	78	0111 1000		332-660	331-659	
2	81	1000 0001		662-990	661-989	
3	82	1000 0010		992-1320	991-1319	
4	83	1000 0011		1322-1650	1321-1649	
5	84	1000 0100		1652-1980	1651-1979	
6	85	1000 0101		1982-2310	1981-2309	
7	86	1000 0110		2312-2640	2311-2639	
8	87	1000 0111		2642-2970	2641-2969	
9	92	1001 0010		2972-3300	2971-3299	
0	94	1001 0100	AMMO L	002-330	001-329	AMMO P
1	96	1001 0110		332-660	331-659	
2	A1	1010 0001		662-990	661-989	
3	A4	1010 0100		992-1320	991-1319	
4	A5	1010 0101		1322-1650	1321-1649	
5	B4	1011 0100		1652-1980	1651-1979	
6	C1	1100 0001		1982-2310	1981-2309	
7	C2	1100 0010		2312-2640	2311-2639	
8	C3	1100 0011		2642-2970	2641-2969	
9	D2	1101 0010		2972-3300	2971-3299	
	E1	1110 0001	Special Codes	002-330	001-329	Special Codes

TABLE - 2

MCC97 BIN LOCATION FOR PID ACTIVE BITS (LOGIC 1)

AMMO TYPE	HEXA DECIMAL PREFIX	BIN LOCATION FOR FIRST LOGIC 1 BIT	BIN LOCATION FOR SECOND LOGIC 1 BIT	BIN LOCATION FOR THIRD LOGIC 1 BIT	BIN LOCATION FOR FOURTH LOGIC 1 BIT
A&E	00	8	8	8	8
A&E	01	8	8	8	10
A&E	02	8	8	10	8
A&E	03	8	8	10	10
A&E	04	8	10	8	8
A&E	05	8	10	8	10
A&E	06	8	10	10	8
A&E	10	8	8	8	6
A&E	20	8	8	6	8
A&E	30	8	8	6	6
B&F	07	8	10	10	10
B&F	08	10	8	8	8
B&F	09	10	8	8	10
B&F	0A	10	8	10	8
B&F	0B	10	8	10	10
B&F	0C	10	10	8	8
B&F	40	8	6	8	8
B&F	50	8	6	8	6
B&F	60	8	6	6	8
B&F	70	8	6	6	6
C&G	0D	10	10	8	10
C&G	0E	10	10	10	8
C&G	0F	10	10	10	10
C&G	12	8	8	10	6
C&G	14	8	10	8	6
C&G	16	8	10	10	6
C&G	80	6	8	8	8
C&G	90	6	8	8	6
C&G	A0	6	8	6	8
C&G	B0	6	8	6	6
D&H	18	10	8	8	6

D&H	1A	10	8	10	6
D&H	1C	10	10	8	6
D&H	1E	10	10	10	6
D&H	21	8	10	6	8
D&H	24	8	8	6	10
D&H	C0	6	6	8	8
D&H	D0	6	6	8	6
D&H	E0	6	6	6	8
D&H	F0	6	6	6	6
I&M	25	8	10	6	10
I&M	28	10	8	6	8
I&M	29	10	8	6	10
I&M	2C	10	10	6	8
I&M	2D	10	10	6	10
I&M	34	8	10	6	6
I&M	38	10	8	6	6
I&M	3C	10	10	6	6
I&M	41	8	6	8	10
I&M	42	8	6	10	8
J&N	43	8	6	10	10
J&N	48	10	6	8	8
J&N	49	10	6	8	10
J&N	4A	10	6	10	8
J&N	4B	10	6	10	10
J&N	52	8	6	10	6
J&N	58	10	6	8	6
J&N	5A	10	6	10	6
J&N	61	8	6	6	10
J&N	68	10	6	6	8
K&O	69	10	6	6	10
K&O	78	10	6	6	6
K&O	81	6	8	8	10
K&O	82	6	8	10	8
K&O	83	6	8	10	10
K&O	84	6	10	8	8
K&O	85	6	10	8	10
K&O	86	6	10	10	8

K&O	87	6	10	10	10
K&O	92	6	8	10	6
L&P	94	6	10	8	6
L&P	96	6	10	10	6
L&P	A1	6	8	6	10
L&P	A4	6	10	6	8
L&P	A5	6	10	6	10
L&P	B4	6	10	6	6
L&P	C1	6	6	10	8
L&P	C2	6	6	8	10
L&P	C3	6	6	10	10
L&P	D2	6	6	10	6
	E1	6	6	6	10

APPENDIX D

TABLE 1 - MILES CODE PARAMETERS FOR DIRECT FIRE ROUTINE

MILES Code No.	No. of Heavy Weapon hit Words (K) / Round	Delay (D1) us	Light Weapon hit Code No.	No. of Light Weapon hit Words (M) / Round	Delay (D2) us	Heavy Weapon Near Miss Code No.	No. of Heavy Weapon Near Miss Words	Delay (D3) us	Light Weapon Near Miss Code No.	No. of Light Weapon Near Miss Words
00	16	0	-	0	0	0	0	0	0	0
01	8	500	27	128	500	28	128	-	-	-
04	8	500	27	128	510	28	128	-	-	-
05	4	500	27	128	500	28	128	-	-	-
06	8	500	27	128	500	28	128	-	-	-
10	4	500	27	128	500	28	128	-	-	-
11	4	500	27	128	500	28	128	-	-	-
12	8	500	27	128	500	28	128	-	-	-
13	8	500	27	128	500	28	128	-	-	-
14	8	500	27	128	500	28	128	-	-	-
15	8	479	27	128	510	28	128	-	-	-
16	8	500	27	128	500	28	128	-	-	-
17	8	500	27	128	500	28	128	-	-	-
18	8	500	27	128	500	28	128	-	-	-
19	8	500	27	128	500	28	128	-	-	-
20	2	500	27	128	500	28	128	-	-	-
21	2	500	27	128	500	28	128	-	-	-
22	2	500	27	128	500	28	128	-	-	-
23	2	500	27	128	500	28	128	-	-	-
24	0	0	24	4	-	-	-	479-542	29	128
25	8	500	27	128	500	28	128	-	-	-
26	8	500	27	128	500	28	128	-	-	-
27	0	0	27	4	-	-	-	479-542	29	128

TABLE 2- MILES CODE PARAMETERS FOR GUIDED MISSILE ROUTINE

S Code No.	IGS Transmit Time for D_A (s)	IGS No. of Messages / second	FGS Transmit Time for D_B (s)	FGS No. of Messages / second	Light Weapon hit Code No.	Delay D1 (ms)	No. of Light WeaponWords	Tracking Interval T(s)	No. of Messages for "Hit" Eval. (GK)
02	TBD	TBD	TBD	TBD	27	121.3	128	TBD	TBD
03	TBD	TBD	TBD	TBD	27	121.3	128	TBD	TBD
07	8	2	2	8	27	121.3	128	10	22
08	4	4	2	8	27	121.3	128	6	22

TABLE 3- MILES CODE PARAMETERS FOR FIRE & FORGET MISSILE ROUTINE

MILES Code No.	AMMO TYPE	Delay D (ms)	No. of Code 09 Words / Round	Delay D1 (ms)	Light Weapon hit Code No.	No. of Light Weapon hit Words	Delay D2 (ms)	Heavy Weapon Near Miss Code No	No. of Near Miss Words	Delay Time for A/V Cue (s)	Total Tran-smit time T(s)	No. of Decoded Words N	Decoding Window Duration T1(s)
09	A & E	0 to 167	224	0	27	16	0	28	32	10	1	4	2

APPENDIX E

TABLE 1 - MILES CODE PARAMETERS FOR ADMINISTRATIVE FUNCTIONS

MILES Code No.	Ammo Type	PID No.	No. of Words (K1)	Controller Gun Function
30	All	All	8	N/A
36	All	All	8	N/A
35	A & E	See Below	8	See Below

CODE 35 PID USEAGE FOR CONTROLLER GUN FUNCTIONS.

The numbers below identify the PIDs associated with Code 35 administrative functions:

PID Decimal	Functions
162	SMAW spotting rifle
1 to 300	SAT Random No. ID, or SAT Checksum data (1-256 only)
301	SAT 'Weapon Code Setup' acknowledge
302	SAT 'On' acknowledge
303	SAT 'Off' acknowledge
304	SAT (spare 1)
305	SAT (spare 2)
306	Surrogate ID request
307	Surrogate ID acknowledge
308	Surrogate AT4 fire
309	Surrogate SMAW fire
310	Surrogate (spare 1)
311	Surrogate (spare 2)
312	Surrogate (spare 3)
313	Turret Position Sensor Signal
314	Turret Position Sensor battery low
315	Set Controller mode ON
316	Set Controller mode OFF
317-330	CIDDS Special Functions
331	Test
661	Time Mark
1321	Enable
1000-1011	Month*
1012-1042	Date*
1043-1049	Day of week (Saturday, Sunday, Monday, etc.)*
1050-1073	Hours after midnight (1050 = midnight)*
1074-1133	Minutes (1074 = 0 minutes)*
1134-1193	Seconds (1134 = 0 seconds)*
1194	Time sync message complete*

*Note: The laser time sync message consists of one PID each of Month, Date, Day of week, Hours after midnight, Minutes, Seconds, and Time sync complete, in that order.

Attachment 1

MCC97 Encoder/Decoder Design Notes

Note 1: **Rapid Fire Weapon, Direct Fire Routine (DFR), Encoding Adaptation.**

Rapid-fire weapons, such as 50 Cal Machine Gun, fired in the burst mode using blank fire ammunition require an encoding adaptation. This configures the DFR for the specific rapid-fire weapon to adequately simulate its enhanced lethality over single shot lethality expectations. In the adaptation, the encoder will suppress the Near Miss Message portion of the DFR as follows:
1. A special blank round detonation sensor system detects the firing of a blank round by sensing its detonation to generate a detonation event signal. This signal informs the encoder of the detonation event.
2. The first round detonation event signal, in a rapid fire burst, initiates the appropriate DFR sequence for the blank ammunition fired.
3. The second and subsequent detonation event signals, in a given rapid fire burst, each initiates the suppression of the encoding of the Near Miss Message portion of the previous fired round's DFR by truncating it. If a second or subsequent detonation signal occurs before the previous DFR Near Miss Message enters encoding sequence, all of it is suppressed. If the signal occurs during the Near Miss Message encoding sequence, the sequence is truncated from that time on.
4. The second or subsequent detonation event signal instantly initiates the next fired round's DFR. The process repeats until the fire burst is completed with the last round resulting in the encoding of the complete DFR appropriate for the given rapid fire weapon.

Note 2: Direct Fire Weapon Lethality Effects Assessment Routine:
When a MILES Decoder successfully decodes two (2) Hit Words within an eight (8) Hit Word transmission time interval, it initiates a **Lethality Effects Assessment Routine (LEAR)** to assess the lethality effects status of the host target based on the decode incident.
There is a range dependency inherent in this implementation. At close ranges, the Decoder can, with high probability of success, decode four (4) pairs of Hit Words out of a received eight (8) Hit Word sequence. The Decoder will initiate the LEAR four times in this case. At long range, due to the lower probability of a successful reception of the transmitted Hit Word signal by the MILES Target System, the Decoder may successfully decoded fewer than four (4) pairs of Hit Words. It probably will initiate the LEAR less than four times.
Since the LEAR is entered more than once, and with high probability, four (4) times at close range, the actual probability for each execution of the LEAR must be set less than the desired single weapon ammunition engagement close range lethality effect status **Kill Probability**. (One **Kill** lethality

effect status assessment outcome from the multiple LEAR executions is sufficient to kill the target.) The equation relating the two probabilities is:

$Pk = 1-(1 - P_w)^D$

- Where Pk = Kill Probability given all Hit Words were received and successfully decoded (close range condition).
- P_w = Kill Probability given a single pair of Hit Words were received and successfully decoded.
- D = Number of executions of the LEAR given perfect reception and decode.

The Decoder will initiate the LEAR when any one of the following events occur:

1. MILES weapon code change is detected.
2. A SPID code change is detected.
3. A 50 ms time interval without signal is detected.

Pk for various weapon's lethality status assessment evaluations are listed in the Pk Table attached herein.

Note 3: Lethality Effects Assessment Routine for Missile Weapons: For Missile Weapons, LEAR is entered using the Pk value corresponding to the Missile Weapon Code in the Pk Table when a Hit is decoded to determine whether the hit caused a kill. The Hit/Kill decision statistics for the Missile Weapons are based upon the weapon and target type involved.

Note 4: Multi-Level Lethality Effects Status For Heavy Weapon Hit. The multi-level lethality effects assessment for will be one of the following categories:

1. Catastrophic Kill (Catk).
2. Firepower Kill (Fk).
3. Mobility Kill (Mk).
4. Commo Kill (Ck).
5. Hit.

LEAR will assess the category for a hit based on the following formula:

1. Catk = Pk x **Ammo Factor** x Aspect Angle Modifier.
2. If a Catastrophic Kill is not assessed, then a Firepower Kill assessment is made where Fk = Catk x Fpk Factor.

3. If a Firepower Kill is not assessed, then a Mobility Kill is assessed where Mk = Catk x Mobk Factor.
4. If a Mobility kill is not assessed, then a Commo kill shall be assessed as Ck = Catk x Comk Factor.
5. If a Commo kill is not assessed, then a Hit is assessed.

The value of **Ammo Factor** is based on the lethality of the particular ammunition. The MCC97 will allow a total of eight (8) Ammo Factors. The exact values for the additional four Ammo factors (#5, #6, #7 & #8) will be specified as additional ammunition are included.

Note 5: Multi-Level Lethality Effects Assessment For Light Weapon Hit.

The multi-level lethality effects assessment will be in one of the following categories:

1. Kill or destroyed.
2. Seriously wounded or seriously damaged
3. Lightly wounded or superficially damaged

Present MILES decoder systems assess category 1 only.